UTILIZATION OF ASSISTIVE TECHNOLOGIES BY VISUALLY IMPAIRED STUDENTS FOR EFFECTIVE INFORMATION ACCESS IN SELECTED FEDERAL UNIVERSITY LIBRARIES IN SOUTH-SOUTH, NIGERIA

BY

UDONTE, ANIEKAN EDO
aniekanudonte@aksu.edu.ng
+2348029571998, +2348117189674

Akwa Ibom State University

Abstracts

The study investigated the utilization of assistive technologies (ATs) for effective information access by visually impaired students of federal university libraries in South-South, Nigeria. Two specific objectives and corresponding research questions were formulated to determine the assistive technologies used in accessing information by the visually impaired that are available, the extent to which the visually impaired utilize adaptive technologies, the methods the visually impaired utilize adaptive technologies, competencies of the visually impaired in the use of available assistive technologies, extent to which assistive technologies contribute to effective information access of the visually impaired, and strategies for enhancing the utilization of adaptive technologies for effective information access by visually impaired in the libraries. The study adopted a descriptive survey design. The population of the study is 205, which consists of 197 visually impaired students and 8 library staff in charge of special library units from four universities under study. A purposive sampling technique was used to draw a sample size of visually impaired users from the population. Focus group discussion sessions, Interview schedules and an observation checklist were the instruments used for data collection which were faced validated by three experts. Descriptive Content analysis was used, thematically on the narratives of the respondents, 106 visually impaired users attended the FGD session, 8 library staff were interviewed and tables with percentages (%) were used to analyze the observation checklist. The challenges associated with the utilization of assistive technologies for effective information access include lack of power supply, inadequate funding by the parents' institutions and the unruly attitude of some library staff among others. Similarly, all the suggested strategies for improving on the challenges were submitted. The major findings revealed that UNICAL has the highest percentage of ATs that are available and functional, while UNIBEN and UNIUYO have the least percentage of ATs that are available and functional, The FGD participants narrated that the extent of their usage is dependent on their level of exposure to it, the method used in utilizing ATs are traditionally based ATs and ICT- based ATs and the Visually impaired students also revealed that ATs enabled them to be independent readers. It was recommended that (i) there should be more campaigns to create awareness on the contributory role of ATs to the visually impaired students of university libraries and also sensitize the staff manning the special library of the inalienable rights of the visually impaired

to access information effectively in university libraries to extend the library hours (ii) there should be constant training and re-training of staff to upgrade their ICT skills and to have more capable hands on deck in handling the information needs of the visually impaired students (iii) universities should provide effective and adequate ICT infrastructures such as computers, and constant power supply and above all information resources should be provided in alternate formats for the visually impaired. These strategies will go a long way in improving the utilization of adaptive technologies for effective information access by visually impaired users of federal university libraries in South-South, Nigeria.

Keywords: Assistive Technology, Adaptive Technology, Effective Information Access, Utilization, Visually Impaired.

Introduction

The university library is an academic library. Academic libraries are found in higher institutions of learning such as colleges of education, polytechnics and in any degree awarding institutions. An academic library is described as a library or library scheme set up managed and financed by the parent's organization to satisfy the information needs, research, and curriculum demands of its learners, academic staff, and other employees. The university library has a statutory function to fulfil its students, lecturers and other staff in the university environment, which is to satisfy the information, research, and curriculum needs. One of the objectives of establishing a university is to promote scholarship, research, and learning in the various fields of speciality. It is apposite to note that behind the mission and vision of the university education is the university library, which is the academic library serving the university community. University libraries are considered one of the fundamental necessities required for the accreditation of academic programmes in all Nigerian universities. The University libraries were proven to meet up with the information needs of their teeming clientele by providing information resources that range from

print to non-print and electronic materials. Information resources are the most important of the services provided by the Library and information centres and are regarded as a critical resource, just as air, water, food, and shelter. Information resources without being utilized effectively are of no consequential value and are termed as useless. Nwezeh and Shabi (2011) also stated that “information resources like books, journals, newspapers, government publications, indexes, and abstracts are all common information materials provided by Universities libraries”. University library extends the academic research supports to all levels of learning of the readers and users. All such support is provided through different services and in offering library services efficiently, efforts are made in terms of how well a service satisfies the demands of the users by making information resources within the university library to be made accessible to every clientele in the academic community and all barriers to information access be removed or reduced. It also helps in acquiring and processing of information resources and make them available to the patrons for easy retrieval and effective utilization. This is the reason, Okunu, Akalumhe, and Monu (2011) stressed that the university library is the heart and blood of the university. The primary purpose of university libraries as could be seen from the above discussion is to support the teaching, learning and research activities of their parent institutions. According to Eze and Uzoigwe (2013) university libraries are at the forefront of providing information services to the different categories of user – students, lecturers, and researchers to support their teaching, learning and research needs. In recent times, new technologies and communication tools have revolutionized the approach and style of library services. The channels for access and distribution of information and knowledge have become much more diverse. While libraries will not be replaced, they will need to adopt new methodologies to take advantage of the new tools. This could be achieved through providing greater access to digital collections while continuing to build and improve access to information resources in all formats to meet the research and

teaching needs of the university and actively fostering user-focused environments committed to identifying and delivering information resources and services that meet or exceed user expectations, regardless of a user location and time.

Effective means to work well to accomplish a purpose, while access is said to be the right of obtaining, making use of or take advantage of something or services. Accessibility is defined as the usability of a product, service, environment or facility by people with a wide range of capabilities. Effective access to information will help the visually impaired to have all the information they need without much stress. It will help the visually impaired in sourcing for information to support their academic and research works. Effective information access provides them with ample opportunity to retrieve a wide variety of information resources. More so, it will enable them to have easy access to information from any geographical location. Therefore, they can become habitual university library patrons. Effective information access is also strongly related to the concept of usability of information resources that is readily available for use in various designs for seekers of information.

Assistive technologies are otherwise known as adaptive technologies. It can be a simple custom made, user-tailored device or an electronic device that provides a solution to help people with various disabilities to live self-reliant rather than helplessly or always asking for help and could at least enable them to perform the certain task easily and independently. In the Library and information science literature, the use of assistive technology has been reported by Brophy and Craven (2007) who highlighted the fact that the terms “assistive”, “adaptive”, “access” or “enabling” technology are often used interchangeably. For Akakandelwa, Stalone and Adibo (2012), adaptive technology includes all devices developed to assist people with disabilities in performing tasks that might be difficult or impossible for them to achieve. The American National Standards Institute/Human Factors and Ergonomics Society (ANSI/HFES, 2008) defines assistive technologies as the set of

properties, products or facilities to be used by people with a wide range of capabilities, either directly or in conjunction with aiding them to accomplish their set of activity of accessing the services provided for them to use.

Furthermore, since visually impaired persons are unable to access and read conventional print, they have the right to read the information in a format that is made available to them, just like their counterparts that can see very well. The visually impaired can use many of the facilities independently if necessary accessibility devices are put in place. Adaptive or assistive technologies are available to provide access to information both in books that are specially printed with dots that are being read by the touch and electronically, giving those visually impaired users equal opportunity. These technologies that are assistive in nature to partially sighted or visually impaired persons are:

- Screen magnifier: This is a software that allows text or graphics on computers to be magnified up to sixteen times the original.
- Screen reader: software that reads out the content of a document to readers. The software program works in conjunction with a speech synthesizer to provide verbalization of everything on the screen including menus, text, and punctuation. It gives persons with visual impairment direct access to the world of print. It also creates independence in reading to the visually impaired. It helps an unsighted or partially sighted individual to read freely at his or her own pace without assistance.
- Voice recognition software: this allows the users to input data into the computer by voice.
- Braille Book: Braille is a system of reading and writing whereby raised dots are used to represent letters that are read by touch. Braille books are appropriate for users who have both visual and hearing impairment.
- Talking newspapers- audio recordings of news articles in the dailies.

- Closed-circuit television: Magnify a printed page through the use of a special television camera with a zoom lens and displays the image on a monitor.
- Talking books- these are audio versions of books that could be recorded on cassettes, CD-ROM, DVD, and the internet as e-books. Talking books are preferred by the majority of the visually impaired.
- Large printed materials- these are documents printed in large fonts for use by partially sighted users.
- White and Mobility cane.
- Talking Watch

Assistive technologies also involve mobility devices such as walkers, wheelchairs and electric scooters, as well as communicative equipment such as hardware, software, and peripherals to assist hearing, speaking and motion-impaired populace. With the help of adaptive technologies, the visually impaired have been rendered special attention to fully participate in the world by providing them with the best possible support necessary to bridge gaps between accessibility and literacy. (Lucky & Achebe., 2013).

Utilization is the state of having been made use of the products and services provided or the action of making practical and effective use of something. Concerted and continuous efforts need to be taken to introduce and maintain assistive technology facilities for the visually impaired user community for effective utilization and access to information resources. According to the United Nations Secretariat for the Convention on the Rights of Persons with Disabilities (2013), 10% of the world's population, or 650 million people, live with a disability of one form or another. Some common disabilities are deformity, loss of limbs, blindness, deafness and mental retardation. These forms of disability affect the degree to which one can move, hear, see, or speak. Categories of persons with special needs according to Nigerian national Policy on Education (2014) will include, Visual Impairment (Blind and the partially sighted); hearing impairment (deaf and the partially hearing); physical and health impairment;

intellectual disability (mild, moderate, severe and profound);emotion and behavior disorders (hyperactive, hypoactive and the socially maladjusted);speech and language impairment; learning disabilities (psychology/neurological phobia or challenges); multiple disabilities; the gifted and talented; and albinos (Vision and Skin problems).Cerebral palsy, Amputee, Dwarfism, Schizophrenia. The needs of students with disabilities differ from those of the general population depending on the type of disability they have. For example, a student who is visually challenged or partially sighted has dissimilar needs from a student who uses a wheelchair or a student who copes with physical disabilities, or those with learning disabilities like hearing impairment and autism.

Visually Impaired persons are considered as a group of individuals that have mild or severe sight hindrance to the extent that he or she is unable to see and must devise alternative techniques to do efficiently those things they would do with sight if they had normal vision. It is also known as persons with visual disabilities. Disability is defined by Dermody and Majekodunmi (2011) as a physical or mental condition that prohibits an individual from use of his or her body (partially, completely and with ease to perform daily tasks). The International Federation of Library Associations and Institutions (IFLA) and the United Nations Educational, Scientific, and Cultural Organization (UNESCO) agreed that there is a large problem; IFLA estimates that there are over 285 million blind and partially sighted people in the world (Marlin, 2014). Print-disabled people include those, “Who cannot effectively read print because of a physical, perceptual, developmental, cognitive, or learning disability” (International Federation of Library Associations and Institutions, 2012). The Library of Congress (LC), under 2 USC 135a-135b, administers the National Library Service (NLS), whose mission is to provide free and accessible library services to United States citizens living in the country or living abroad, who, due to blindness, visual, physical, or other disabilities, cannot read print materials (Library of Congress, 2014).

South-South, Nigeria is a geopolitical zone that is made up of six states, namely Akwa Ibom State, Bayelsa State, Cross River State, Delta State, Edo State, and Rivers State. There are five conventional federal universities in each of the States, except Delta state that has a specialized university of Petroleum Training Institutes, Effurun and the federal university in Otueke, Bayelsa state that will not be excluded among the conventional federal institutions of higher learning to be considered for the study.

Statement of the Problem

- Ineffective access to information could frustrate the information needs of the visually impaired. This condition can cause them to record or experience poor academic performance.
- Ineffective access to information could make them consider quitting their educational ambition. Invariably it would be against the objectives of information ethics which the librarians have sworn to protect and oblige to.

Purpose of the Study

The general purpose of this study is to investigate the utilization of adaptive technology for effective information access by the visually impaired in federal university libraries in South-South, Nigeria. Specifically, the study is set to:

- identify the adaptive technologies used in accessing information by the visually impaired that are available in the federal university libraries in South South, Nigeria.
- determine the extent to which the visually impaired utilize adaptive technologies in accessing information in the libraries.
- determine the methods the visually impaired utilize adaptive technologies in accessing information in the libraries.

Research Questions

The following research questions were formulated to guide the study:

- What adaptive technologies used in accessing information by the visually impaired are available in the federal university libraries in south south, Nigeria?
- What is the extent to which the visually impaired utilize adaptive technologies in accessing information in the libraries?
- What are the methods the visually impaired employ to utilize adaptive technologies in accessing information in the libraries?

The population of the Study

Focus Group Discussion for Visually Impaired Students

S/N	Selected University Libraries in South South	No. of Visually Impaired Students	No. of FGD Participants
1	University of Benin	37	**20**
2	University of Calabar	112	**53**
3	University of Port Harcourt	26	**15**
4	University of Uyo	22	**17**
	Total	**197**	**106**

The population of the study consisted of 197 visually impaired students and 8 university library staff in charge of the special library unit in the federal university libraries in South-South, which makes 205 the total number. The visually impaired students from the nominal roll in the four university libraries are as follows: University of Calabar 112, University of Uyo 22, University of Port Harcourt 26, and University of Benin 37. The visually impaired users were chosen because they are the most identifiable group among persons with special needs in the university environment and the university library staff were included in the study because as the library staff working in the special units of the university libraries they are in better positions to provide reliable information on the state of adaptive technologies in the libraries.

Sample and Sampling Technique

The study used the 205 population made up of 8 library staff and 197 visually impaired students, which consist of four different groups in the federal universities understudy for a discussion group and with two librarians working in the special units from each of the four university libraries that will not be among the discussion group but will be personally interviewed. Therefore, no sampling was done.

Instruments for Data Collection

The instruments for data collection were an observation checklist, focus group discussion guide and interview schedule. The focus group discussion guide was structured to elicit information on the utilization of adaptive technology for effective access to information. Focus group discussions involve discussing and hearing from others. The focus group discussion guide is divided into two parts. The first part covered the demographic information of the visually impaired respondents. The Second Part is the focus group discussion guide. It has nine segments, the segments treated: welcome address, introduction, anonymity, confidentiality statement, rules,

familiarization, introductory question, guiding question, concluding question and conclusion.

A structured face-to-face interview was used to elicit information from the staff working in the university libraries understudy on the state of adaptive technologies in the libraries. The structured interview has two segments. The first segment is the introduction. The second segment is the interview question guide.

The researcher adopted observation checklist in data collection on the adaptive technologies available and functional, those that are available but not functional and those facilities that are not available for utilization, for effective information access by the visually impaired users of the university libraries. The observation checklist consists of 24 items which were used by the researcher to physically check the infrastructural facilities in the special unit of each of the university libraries under study. The observation checklist is important for the researcher in this study because it tends to produce answers to the research question 1 of the study, that explored the adaptive technologies used in accessing information by the visually impaired that are available in the federal university libraries in South South, Nigeria.

Method of Data Collection

The researcher with the help of an assistant moderator conducted the focus group discussion with the visually impaired students in the universities under study. The role of the assistant moderator is to help with equipment and refreshments, arrange the room, welcome participants as they arrive, sit in designated locations, take notes throughout the discussion, operate recording equipment, do not participate in the discussion, ask questions when invited, give an oral summary debrief with the moderator (researcher) and give feedback on analysis and reports. Focus group discussions involve discussing and hearing from others. Similarly, an observation checklist was used by the researcher to physically determine the extent of availability and

functionality of the adaptive technologies being utilized for effective information service by the visually impaired users of the university libraries under study.

Method of Data Analysis

Data collected from the focus group discussion and the interview schedule were analysed qualitatively with thematic content analysis while the observation checklist was quantitatively used to ascertain the availability and functionality of the ATs in the university libraries under study using frequencies and percentages. Qualitative content analysis as defined by Hiesh and Shannon (2005) is a research method for the subjective interpretation of the content of text data through the systematic classification process of coding and identifying themes or patterns (Thematic Analysis). Zhang & Widemuth (2009) asserted that content or thematic analysis consists of a series of coded words gotten from the respondents through the rigorous process of analysis of moving back and forth to the point of saturation.

Data analysis steps by themes, categories and subcategories

RQs	THEMES	CATs	S-CATs
2. what is the extent to which the visually impaired utilize adaptive technologies in	Academics	1. Online communication technologies 2. Braille books	1. Academic search tools 2. Library hours 3. Accessibility problem

accessing information in the libraries?		3. Voice recorder	4. Lectures
3. what are the methods the visually impaired utilize adaptive technologies in accessing information in the libraries?	Traditional Adaptive Technologies ICT-based Adaptive Technologies	1. Less capital-intensive technologies 2. Capital intensive technologies	**1.** Braille books **2.** Handheld magnifier **3.** Recordings **4.** Computers with JAWS softwares **5.** Screen readers on Phones **6.** Braille translation softwares

KEYS

RQs	**RESEARCH QUESTION**
CATs	**CATEGORIES**
S-CATs	**SUB-CATEGORIES**

Summary of the Major Findings

- The researcher observed that ATs available in the university libraries under study include; UNICAL has the highest percentage that are available and functional, and UNIUYO has the highest percentage of ATs that are not available and least percentage that are available and functional.

- The FGD participant's showed that they are technology savvy, the visually impaired users of the university libraries under study revealed the extent of their utilization of ATs is dependent on their level of exposure to it.
- The FGD participants made some revelations about the methods they utilize adaptive technologies in accessing information in libraries in respect to the main themes (traditional adaptive technologies and ICT-based adaptive technologies). Traditional adaptive technologies like Braille's and Voice recorder are commonly used as reported by the visually impaired.

Implication of the study

- The study has some implications for effective access to information through the utilization of adaptive technologies by the visually impaired users of the university libraries. The results on the availability of the ATs in the entire university libraries under study has it that one out of the four universities has ICT-based ATs while the others are equipped with the conventional ATs. This implies that only students those that are exposed to computer based ATs will follow the current and global trend while the others who not expose to the ICT based ATs because of the inability of their institution to provide for their use will have to seek help from elsewhere to move with the current trends of using ATs to access information effectively.
- Another implication is that, most visually impaired students of the university library under study that are not technologically savvy will not be able to make use of real-time online resources that the university provides, have to access institutional repositories, e-mail, social media, digital references services as well as other benefits they could have had if they were independents in browsing the internet, all

these is made possible through information and communication technology.

- The result of the findings showed that ATs are indispensable to the visually impaired students of the university under study for their involvement in learning, reading, doing their assignments, term papers, seminars and research work yet not enough attention and advocacy is accorded to these set of users for their contribution to national growth and development and despite the national policy on education that directed all the stakeholders in education to absorb the policy of inclusiveness in implementation of educational programmes at all level of education. Most university administrations and the library management tend to exclude the users of the special units of the library, by negating their responsibilities of providing them with a conducive environment for learning. The implication is that the inalienable right to proper education and library use is taken away from them and infringed upon, leaving them to fend for themselves means they are not regarded or they have pushed aside in the academic settings.

Recommendations

Following the findings of this study, the following recommendations are made to ensure the utilization of adaptive technologies for effective information access by visually impaired users in federal university libraries in South South, Nigeria.

- Government should increase funding for the provision of Adaptive technologies that are ICT based. Budgetary allocation of the library which is 10% of the university's annual budget should be adhered to and released for subscriptions and maintenance of overhead costs of the day-to-day running of the university library.

- Library management should as a matter of policy enforce library orientation to its students with visual impairments for the effective utilization of ATs in accessing information. The library management should sensitize and acquaint the visually impaired students differently from the sighted or able students because their information needs are unique and should be given priority differently.
- The study equally showed that much could be done to alleviate the difficulties encountered during utilization of ATs by providing backup power to support the electricity supply from the national grid.
- More university library staff should be trained as more hands are needed to be able to operate in the international standard required of a staff working in a special unit of a university library. Above all, the staff should be taught how to be friendly and service-oriented in an academic environment so that harmonious rapport can be established between the library staff and the university teaching staff to help serve the visually impaired students better.

Conclusion

Several conclusions were drawn from this study that sought to explore the utilization of ATs for effective information access by the visually impaired users of the federal university libraries, South-South, Nigeria. This has brought forth, findings that deserve the attention of university management, administrators, and librarians in charge of special units of the university libraries. First, it is established that visually impaired users are technology savvy in the sense that they can make use of available ICT-based ATs to access information. Second, it revealed that the infrastructural facilities provided by the university management for use by visually impaired were not adequate when their experience with the infrastructures was sought.

Third, the study revealed that the visually impaired students utilized the ATs often and their capabilities in utilizing the available ATs in their respective university libraries are high and very high.

However, the visually impaired students are aware of the resources and services mentioned, their utilization of ATs is at optimum but is limited to factors like the availability and functionality of ATs in the university libraries. The visually impaired extent of usage of ATs depends on the available ones that are functional. Fourth, the study revealed that the reasons preventing the use of ATs are the lack of hospitality on the part of the library staff in charge of the special unit, incessant power outages, irregular updates of the software, non-maintenances of computers, insufficient funding and others. In addition, it was established that university management should obey the 10% allocation of the institution's annual budget to the library funding, the training of the library staff for effective service delivery and educating them on library marketing and advocacy to enable them to source for funds, donations bequeaths form organisation that is willing to help.

Finally, federal university libraries in South-South should endeavour to provide information in alternate formats other than buying them because of their scarcity in the markets. Nevertheless, the library management should engage in visually impaired student orientation programme to create awareness and education on the utilization of ATs for effective information access.

-

REFERENCES

Akakandelwa, A., Stalone, B., & Adibo, S. (2012). The Adoption of Assistive Technologies in Ademic Libraries: A Case of Library Users with Visual and Hearing Impairment at Kyambogo University in Uganda. *SCESCAL XX Conference.* Nairobi, Kenya, 4th-8th June 2012.

American National Standards Institute/Human Factors and Ergonomics Society (ANSI/HFES). (2008). ANSI/HFES200 human factors engineering of software user interfaces. Retrieved April 25, 2019, from www.hfes.org/Publications/ProductDetail.aspx?ID¼79.

Brophy, P. & Craven, J. (2007). Web accessibility. *Library Trends,* 55(4), 950-972.

Dermody, K., & Majekodunmi, N. (2011). Online databases and the research experience for university students with print disabilities. *Library Hi Tech,* 29(1), 149-160.

Eze, J. & C.U.O., (2013). The place of academic libraries in Nigerian university education.: Contributing to the 'Education for All' initiative. *International Journal of Library and Information Science,* 7(3), 433-438.

Federal Republic of Nigeria. (2014). National Policy on Education. Abuja: Federal Ministry of Education.

Hiesh H. and Shannon S. E (2005). Qualitative Health Research: Three Approach to Qualitative Content Analysis, SAGE publications.

International Federation of Library Associations and Institutes. (2012). *International Federation of Library IFLA Manifesto for libraries Servicing Persons with a Print Disability.* Hague: IFLA.

Library of Congress. (2014). *Library of Congress Fiscal 2014 Budget Justification. Submitted for Use by the Committee on Appropriations.* Washington, DC: Library of Congress. Retrieved May 2, 2019, from http://www.loc.gov/portals/static/about/report-and-budget:http://www.loc/gov/protals/static/about reports-and-budgets/pdf/fy2013.pdf.

Lucky, A., & Achebe., N. (2013). Information Service Delivery to the Visually Impaired: A Case Study of Hope for the Blind Foundation Wusasa, Zaria: *Research Journal of Information Technology, 5*(1), 18-23.

Marlin, M. (2014). Promoting access for Blind and Visually Impaired Patrons. An IFLA manifesto and its strategic importance for American libraries. *American Libraries, 45*(11), 21-22.

Nwezeh, C., & Shabi, I. (2011). Students' use of academic libraries in Nigeria: A Case of Obafemi Awolowo University Library, Ile Ife. Library philosophy and practice. Ile Ife, Osun, Nigeria. Retrieved April 23, 2019, from http://digitalcommons.unl.edu/ libphilprac/602.

Okunu, H., Akalumbe, K., & Monu, J. (2011). An evaluative study of academic library services to users in Nigerian universities: A case study of Fatiu Ademola Akesode Library. *An evaluative study of academic library services to users in Niger International Journal of Research in Education,* 8(1), 82-91.

UNESCO, (2006). ICTs in education for people with special needs. Retrieved July 1, 2019, from http://iite.unesco.org/pics/publicaitons/en/files/3214644.pdf.

Zhang, Y., & Widemuth, B. (2009). Qualitative Analysis in B. Wildemouth (ed). Application of Social Research Methods to Questions in Information of Social Research Methods to Questions in Information and Library Science. Westport CT: *CT Libraries Unlimited*. Retrieved October 13, 2019, from https://www.ischool.utexas.edu/~yanz/publication.htm

OBSERVATION CHECKLIST ON AVAILABLE ADAPTIVE TECHNOLOGIES IN FEDERAL UNIVERSITIES, SOUTH-SOUTH NIGERIA FOR VISUALLY IMPAIRED STUDENTS (OCLAATFUSNVIS)

S/N	Resources available and accessible	AF	ANF	NA
A	**Traditional Adaptive Technologies**			
1	Large print books			
2	Braille books			
3	Audio or talking books			
4	Tape-recording of books in CDs/DVDs			
5	Tape-recording of notes on CDs/DVDs			
6	Tape-recording of the handout on CDs/DVDs			
7	Tactile representations as an alternative to graphic images			
8	Raised lines drawings			
9	Handheld magnifiers			
B	**ICT-based Adaptive Technologies**			
10	Computers			
11	Computer with optical character readers			
12	Computer with Voice output software/ TTS (text to speech)			
13	Computer with JAWS Talking Software			
14	Closed-circuit television			
15	Math Scanning and Reading Software InftyReader			
16	Tactile Drawing Boards			
17	Computer with Screen Enlarger			
18	Computer with Braille screen display			
19	Computer with Braille embosser			
20	Computer with printer output			
21	Scanner			
22	Perkins Braille machine			
23	Electronic format of Audiobooks from the internet			
24	Smartphones – with Haptic Touch Features			
C	Others (Please Specify)			

Key:

AF – Available and Functional **ANF** – Available Not Functional **NA** – Not Available

Traditional Adaptive Technologies	**UNICAL Traditional adaptive technology**	**UNIPORT Traditional adaptive technology**	**UNIBEN Traditional adaptive technology**	**UNIYO Traditional adaptive technology**
Large print books Braille books Audio or talking books Tape-recording of books on CDs/DVDs Tape-recording of notes on CDs/DVDs Tape-recording of the handout on CDs/DVDs Tactile representations as an alternative to graphic images Raised lines drawings Handheld magnifiers	**AF** **freq** = 8 Total items= 9 %= 8÷9×100= 89 **ANF** **freq =** 0 Total items= 9 %= 0÷9×100= 0 **NA** **freq =** 1 Total items= 9 %= 1÷9×100= 11	**AF** **freq** = 6 Total items= 9 %= 6÷9×100= 67 **ANF** **freq =** 1 Total items= 9 %= 1÷9×100= 11 **NA** **freq =** 2 Total items= 9 %= 2÷9×100= 22	**AF** **freq** = 6 Total items= 9 %= 6÷9×100= 67 **ANF** **freq =** 1 Total items= 9 %= 1÷9×100= 11 **NA** **freq =** 2 Total items= 9 %= 2÷9×100= 22	**AF** **freq** = 6 Total items= 9 %= 6÷9×100= 67 **ANF** **freq =** 0 Total items= 9 %= 0÷9×100= 0 **NA** **freq =** 3 Total items= 9 %= 3÷9×100=33
ICT-based Adaptive Technologies	**ICT-Based adaptive technology**	**ICT-Based adaptive technology**	**ICT-Based adaptive technology**	**ICT-Based adaptive technology**
Computers Computer with optical character readers Computer with Voice output software/ TTS (text to speech) Computer with JAWS Talking Software Closed-circuit television Math Scanning and Reading Software InftyReader Tactile Drawing	**AF** **freq** = 11 Total items= 15 %= 11÷15×100= 73 **ANF** **freq =** 0 Total items= 15 %= 0÷15×100=0 **NA** **freq =** 4 Total items= 15 %= 4÷15×100= 27 **Total= 200**	**AF** **freq** = 7 Total items= 15 %= 7÷15×100= 47 **ANF** **freq =** 0 Total items= 15 %= 0÷15×100=0 **NA** **freq =** 8 Total items= 15 %=	**AF** **freq** = 7 Total items= 15 %= 7÷15×100= 47 **ANF** **freq =** 0 Total items= 15 %= 0÷15×100=0 **NA** **freq =** 8 Total items= 15 %=	**AF** **freq** = 6 Total items= 15 %= 6÷15×100= 40 **ANF** **freq =** 2 Total items= 15 %= 2÷15×100=13 **NA** **freq =** 7 Total items= 15 %= 7÷15×100= 47 **200**

Boards Computer with Screen Enlarger Computer with Braille Screen Display Computer with Braille Embosser Computer with Printer Output Scanner Perkins Braille Machine Electronic Format of Audiobooks from the Internet Smartphones- with Haptic Touch Features		8÷15×100= 53 **200**	8÷15×100= 53 **200**	

Key:
AF – Available and functional **ANF** – Available not functional **NA** – Not Available
Freq – Frequency **V** - Percentage